Value of Riparian Buffers

John Magee
New Hampshire Fish and Game Department
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Riparian areas are essential for the protection of water quality and the proliferation of aquatic organisms. "Riparian areas reduce nitrogen pollution through nutrient uptake and assimilation by vegetation, and the transformation of dissolved nitrogen to nitrogen gas that is returned to the atmosphere through microbial *denitrification*. The nitrogen carried in flood flows and runoff becomes available to riparian vegetation as nitrogen rich surface water enters shallow groundwater" (Chagrin River Watershed Partners, Inc., 2006). Riparian vegetation, especially tall shrubs and trees, keeps flowing waters cool by providing shade. Wilkerson et al (2006) reported statistically significant increases in mean weekly maximum water temperature of small headwater (i.e., first order) streams in western Maine following the complete removal of riparian vegetation. The mean daily fluctuation in water temperature also increased (by 1.5 – 3.8°C). These reported increases could extirpate entire populations of brook trout and other fish in many streams by increasing the water temperature above their thermal tolerances (Izaak and Hubert, 2004; Magee, 2006). Uncut riparian buffers of 11m (~34 feet) showed a minor, but statistically insignificant increase (1.0-1.4°C) in mean weekly maximum water temperature. However, this increase may indeed be biologically significant.

Riparian vegetation is an essential component of stream stability (Gregory et al., 1991). Roots of larger trees and shrubs provide increased streambank stability, while more shallow rooted plants (e.g. grasses) typically provide less streambank stability. The value of the stream stability is exceptionally important during floods.

Riparian areas are also important for the natural retention of floodwaters. "Flooding is a natural restorative process for riparian systems that maintains the form, function, and connectivity of stream channels and their floodplains. Riparian setbacks maintain the natural connection between rivers and their adjacent floodplains and protect the floodplain's natural functions in storing and attenuating flood flows. These floodplain services offer low maintenance cost-effective solutions to community flooding" (Chagrin River Watershed Partners, Inc., 2006).

In recent years, empirical investigations have clearly demonstrated that there is a very strong connection between riparian and aquatic ecosystems (e.g., Gregory et al. 1991). Naiman and Latterell (2005) summarized a large number of studies and convincingly argue that the biological link between these two ecosystems is sufficiently strong to consider riparian areas as fish habitat, recognizing that fish do not actually inhabit the riparian area except perhaps during very high flows. As summarized by Naiman and Latterell (2005), riparian areas clearly serve as a source of 1) food for fish (e.g., terrestrial insects that fall into the stream and are consumed by fish; e.g., Utz and Hartman, 2006), 2) food for macroinvertebrates (as in leaves, wood, and dissolved organic matter) 3) wood, which is essential in the formation of aquatic habitat required by fish and

macroinvertebrates and in retaining leaves, and 4) habitat and nesting areas for other species dependant on aquatic ecosystems (e.g. furbearers and waterfowl). Wood and leaves form the basis of the food chain in headwater streams where primary production in the stream channel is limited by the lack of direct sunlight. Fungi and bacteria, which use the wood and leaves that fall into the stream as a source of carbon and obtain nutrients directly from the water, are in turn consumed by macroinvertebrates, many of which become the prey of fish. In particular, large trees in the riparian area carry specific long-term importance in that it takes decades to hundreds of years for trees to grow large, die, and then fall into streams where they provide shelter for fish and macroinvertebrates and serve as channel forming elements. The importance of wood in streams/rivers (e.g., Montgomery and Pie´gay, 2003) and lakes (e.g., Sass et al., 2006) has been well established.

Because the majority of stream miles in New Hampshire is in 1st, 2nd and 3rd order streams, protecting the stability and ecological integrity of them is of paramount importance to protecting water quality in all waterbodies of the state and to providing the continued use of biological resources by the people of New Hampshire.

Literature cited

Riparian Setbacks, Technical Information for Decision Makers. 2006. Willoughby, OH. Available at: http://www.crwp.org/pdf_files/riparian_setback_paper_jan_2006.pdf. Accessed on October 4, 2006.

Gregory, S.V., S.J. Swanson, W.A. McKee, and K.W. Cummings. 1991. An ecosystem perspective of riparian zones. Bioscience 41:540-551.

Izaak, D. J. and W. A. Hubert. 20046. Nonlinear Response of Trout Abundance to Summer Stream Temperatures across a Thermally Diverse Montane Landscape. Trans. Amer. Fish. Soc. 133:1254-1259.

Magee, J.A. 2006. Don't lose your cool: Thermal tolerances of brook trout in New Hampshire. 136th Annual American Fisheries Society Meeting, Lake Placid, NY. September 11-14, 2006.

Montgomery, D.R., and H. Pie´gay. 2003. Wood in rivers: interactions with channel morphology and processes. Geomorphol. 51:1-5.

Naiman, R. J. and J.J. Latterell. 2005. Principles for linking fish habitat to fisheries management and conservation. J. Fish Biol. 67 (Suppl B):166-185.

Utz, R.M. and K.J. Hartman. Identification of critical prey items to Appalachian brook trout (Salvelinus fontinalis) with emphasis on terrestrial organisms. Hydrobiologia. DOI: 10.1007/s10750-006-0372-0. Published online on September 25, 2006 at: http://www.springerlink.com/content/bv17k07q59k72623/?p=6521d2c994cb4b6b9dacb593ca150d23&pi=0. Accessed October 9, 2006.